CLAIMS

What is claimed is:

1. A method of making a filled dough product, comprising:

providing an extrusion head including

- an outer horn having an outer horn passageway extending a first axial length between an outer horn inlet to an outer horn outlet, and

- an inner horn located co-axially inside and circumferentially separated from the outer horn to define the outer horn passageway therebetween, wherein the inner horn has an inner horn passageway extending a second axial length between an inner horn inlet to an inner horn outlet;

conducting dough through the outer horn passageway to the outer horn outlet and an edible filling material through the inner horn passageway to the inner horn outlet, wherein dough discharged from the outer horn outlet enrobes edible filling material discharged from the inner horn outlet to form an extruded rope;

wherein the providing of the extrusion head includes selecting the first and second axial lengths, respectively, such that the discharging of the dough occurs with less dough shearing than when either the first or second axial lengths is larger.

2. The method of claim 1, wherein the outer horn passageway tapers inwardly in cross sectional shape from the outer horn inlet to the outer horn outlet.

3. The method of claim 1, wherein the inner horn passageway has a substantially constant cross sectional diameter from the inner horn inlet to the inner horn outlet, and wherein the inner horn outlet is located axially within the outer horn passageway.

4. The method of claim 1, wherein the outer horn has an L/D ratio value, measured as the ratio of the outer horn length (L)/outer horn average internal diameter (D), of less than 5.0.

5. The method of claim 1, wherein the outer horn has an L/D ratio value, measured as the ratio of the outer horn length (L)/outer horn average internal diameter (D), in the range of 3.0 to 4.0.

6. The method of claim 1, wherein a cross sectional shape of the extruded rope substantially corresponds to a cross sectional shape of the extruded rope when either the outer horn axial length or the inner horn axial length is enlarged to the extent the dough incurs more shearing.

7. The method of claim 1, wherein the outer horn and inner horn are both arranged substantially horizontally relative to force of gravity.

8. The method of claim 1, wherein the dough material comprises a protein content of at least about 11%.

9. The method of claim 1, wherein the edible filling material comprises an extrudable material selected from a processed meat product, a dairy product, an egg product, a seafood product, a processed legume product, a processed vegetable product, a processed fruit product, individually or in any combination thereof.

10. The method of claim 1, wherein the filling material comprises cream cheese.

11. A method for making a filled bagel product, comprising:

providing:

- an extrusion head comprising:

-an outer horn having an outer horn passageway extending a first axial length between an outer horn inlet to an outer horn outlet,

- an inner horn located co-axially inside and circumferentially separated from the outer horn to define the outer horn passageway therebetween, wherein the inner horn has an inner horn passageway extending a second axial length between an inner horn inlet to an inner horn outlet,

- a bagel dough supply, and a dough transport mechanism between the bagel dough supply and the outer horn,

- an edible filling material supply, and a filling feeding mechanism between the filling material supply and the inner horn,

conducting bagel dough through the outer horn passageway to the outer horn outlet and an edible filling material through the inner horn passageway to the inner horn outlet, wherein bagel dough discharged from the outer horn outlet enrobes edible filling material discharged from the inner horn outlet to form an extruded rope, wherein the providing of the extrusion head includes selecting the first and second axial lengths, respectively, such that the discharging of the bagel dough occurs with less dough shearing than when either the first or second axial lengths is larger;

cutting the extruded rope into at least one filled bagel dough segment having a first free end and second free end; and

connecting the first and second free ends together to form a continuous ring-shaped food product.

12. The method of claim 11, further including the steps of:

proofing the ring-shaped food product effective to activate a yeast to raise the bagel dough through fermentation;

cooking the bagel dough of the ring-shaped food product after proofing by a surface heating procedure selected from steaming, boiling, or a combination thereof.

13. The method of claim 12, wherein the cooking comprising boiling.

14. The method of claim 11, the conducting of the bagel dough comprises drawing a vacuum pressure on the bagel dough supply of a magnitude effective for (i) entraining bagel dough into the dough transport mechanism such that bagel dough discharged from the outer horn discharge outlet enrobes filling material discharged from the inner horn outlet to form an extruded rope, and (ii) causing intermittent pauses in the discharge of bagel dough from the outer horn outlet wherein the discharged bagel dough is less sheared than bagel dough supplied at a greater magnitude of vacuum pressure sufficient to discharge the bagel dough from the outer horn outlet without the pauses.

15. The method of claim 11, wherein the first axial length of the outer horn is selected to be about 25 to about 35% shorter in length than a larger axial length where opaque dough occurs.

16. The method of claim 11, wherein the second axial length of the inner horn being selected to be about 35 to about 45% shorter in length than a larger axial length where dough shearing occurs.

17. The method of claim 11, wherein the outer horn passageway tapers inwardly in cross sectional shape from the outer horn inlet to the outer horn outlet.

18. The method of claim 11, wherein the inner horn passageway has a substantially constant cross sectional diameter from the inner horn inlet to the inner horn outlet, and wherein the inner horn outlet is located axially within the outer horn passageway.

19. The method of claim 11, wherein the outer horn has an L/D ratio value, measured as the ratio of the outer horn length (L)/outer horn average internal diameter (D), of less than 5.0.

20. The method of claim 11, wherein the outer horn has an L/D ratio value, measured as the ratio of the outer horn length (L)/outer horn average internal diameter (D), in the range of 3.0 to 4.0.

21. The method of claim 11, wherein the dough transport mechanism and the filling feeding mechanism each comprise a twin-screw conveyor.

22. The method of claim 11, wherein a cross sectional shape of the extruded rope substantially corresponds to a cross sectional shape of the extruded rope when either the outer horn axial length or the inner horn axial length is enlarged to the extent that the dough incurs more shearing.

23. The method of claim 11, wherein the outer horn and inner horn are both arranged substantially horizontally relative to force of gravity.

24. The method of claim 11, wherein the bagel dough material comprises a protein content of at least about 11%.

25. The method of claim 11, wherein the edible filling material comprises an extrudable material selected from a processed meat product, a dairy product, an egg product, a seafood product, a processed legume product, a processed vegetable product, a processed fruit product, individually or in any combination thereof.

26. The method of claim 11, wherein the filling material comprises cream cheese.

27. The method of claim 11, wherein the filling material comprises an extrudable food material selected from cheese, egg product, and meat, individually or in a combination thereof.

28. An extrusion head useful for making filled food products, comprising:

an outer horn having an outer horn passageway extending a first axial length between an outer horn inlet adapted to receive a coating food to an outer horn outlet adapted to discharge the coating food, wherein the outer horn passageway tapers inwardly in cross sectional shape from the outer horn inlet to the outer horn outlet; and

an inner horn located co-axially inside and circumferentially separated from the outer horn to define the outer horn passageway therebetween, wherein the inner horn has an inner horn passageway extending a second axial length between an inner horn inlet adapted to receive filling material to an inner horn outlet adapted to discharge filling material, wherein the second passageway of the second horn has a substantially constant cross sectional diameter from the inner horn inlet to the inner horn outlet, and wherein the inner horn outlet is located axially within the outer horn passageway, and wherein the outer horn and inner horn are both arranged substantially horizontally relative to force of gravity.

29. An extruder for making filled food products, comprising:

an extrusion head comprising:

- an outer horn having an outer horn passageway extending a first axial length between an outer horn inlet adapted to receive a coating food to an outer horn outlet adapted to discharge the coating food, wherein the outer horn passageway tapers inwardly in cross sectional shape from the outer horn inlet to the outer horn outlet,

- an inner horn located co-axially inside and circumferentially separated from the outer horn to define the outer horn passageway therebetween, wherein the inner horn has an inner horn passageway extending a second axial length between an inner horn inlet adapted to receive filling material to an inner horn outlet adapted to discharge filling material, wherein the second passageway of the second horn has a substantially constant cross sectional diameter from the inner horn inlet to the inner horn outlet, and wherein the inner horn outlet is located axially within the outer horn passageway, and wherein the outer horn and inner horn are both arranged

substantially horizontally relative to force of gravity;

a dough supply container, and a dough transport mechanism between the dough supply container and the outer horn; and

an edible filling material supply container, and a filling feed mechanism operable to conduct filling material from the edible filling material supply container to the inner horn.